# Bean Road Tunnel

## Air Quality Dust Assessment

11/06/2019

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# 1. Introduction

The Bean Road Tunnel is a proposed tunnel which would run under the B255 Bean Road connecting the Bluewater Shopping Centre (Kent) on the west side of the tunnel to The Eastern Quarry to the east of the tunnel.

The Eastern Quarry is currently undergoing development and is to be transformed it into “Ebbsfleet Garden City”, a new development of homes, offices and leisure, located on the east side of the tunnel. The tunnel is designed to increase access for Fastrack electric buses, pedestrians and cyclists between the Ebbsfleet Garden City and the Bluewater Shopping Centre.

Activities carried out on construction sites (e.g. demolition, land clearing or grading, earth moving and excavation) can give rise to emissions of dust, which could cause annoyance to people or damage to vegetation due to the soiling of surfaces. These activities can also lead to increased short-term and long-term concentrations of fine particulate matter (e.g. $PM_{10}$ and $PM_{2.5}$) at off-site locations. This may affect human health, unless the appropriate mitigation measures are implemented. The impacts of dust emissions from the activities associated with the construction of the Bean Road Tunnel need to be addressed in order to identify the required mitigation measures.

There are locations close to the Bean Road Tunnel Site which are potentially sensitive to dust soiling and $PM_{10}$, including the Bluewater Shopping Centre and its associated car park. Activities associated with the construction of the Bean Road Tunnel have the potential to produce emissions of dust that could be transported towards receptors by the wind. These are close enough to the Shopping Centre that, without mitigation measures, they could perceive increases in the rate of dust deposition in the area.

This report sets out the assessment of emissions of dust and $PM_{10}$ which could potentially occur during the construction of the Bean Road Tunnel and has been carried out in accordance with the latest Institute of Air Quality Management (IAQM) guidance[1] on the assessment of dust from demolition and construction. It details the full construction dust assessment, including a description of the methodology, relevant input data, the assessment itself, recommended mitigation and monitoring measures, and conclusions.

The description provided is based on the information available at the time of writing and may be subject to change as the final design details are developed. However, at this stage it is considered that the information provided is sufficient to identify any likely impacts of dust emissions from the activities associated with the Bean Road Tunnel construction.

Recommended mitigation measures taken forward from this assessment should be adopted within a Construction Environmental Management Plan (CEMP).

The Bean Road Tunnel scheme is not anticipated to have an impact on sensitive receptors in the vicinity of the local road network in either the construction or operational phase as a result of pollutant emissions from road traffic. The Annual Average Daily Traffic (AADT) flow generated by construction is estimated to be less than 10[2], and the tunnel will only be used by electric buses and cycles, thus not adding $NO_x$

[1] Institute of Air Quality Management (IAQM). 2016. *Guidance on the Assessment of Dust from Demolition and Construction Version 1.1*. London: Institute of Air Quality Management.
[2] Early estimation provided by members of the project team

(oxides of nitrogen) emitting vehicles onto the local network. Assessment of these has therefore been screened out, as the impacts on air quality will likely be negligible.

## 1.1 Assessment Overview

The assessment of dust during construction has been carried out using a qualitative risk-based appraisal with reference to the location of the Bean Road Tunnel site in relation to sensitive receptors, the planned processes, and site characteristics, as described in IAQM guidance[1]. Based on the calculated risk level, IAQM guidance[1] sets out clear requirements for the recommended mitigation measures which can be used to minimise the impact of dust during the construction phase of a development.

IAQM guidance[1] aims to estimate the impacts of both $PM_{10}$ and dust together, through a combined risk-based assessment procedure. IAQM guidance[1] provides a methodological framework but notes that professional judgement is required to assess impacts. The key elements of the guidance are presented in Appendix A.

This assessment does not consider the risk of exposure to contaminated dusts that could arise from the remediation of contaminated land.

Larger dust particles (greater than 30 µm) make up the greatest proportion of dust emissions from mineral workings or earthworks and will largely deposit within 100 m of sources[3]. Intermediate sized particles (10 µm–30 µm) are likely to travel further distance. $PM_{10}$, including $PM_{2.5}$, are reported to make up a smaller proportion (approximately 10%) of dust emitted from most workings and the emissions become diluted as they disperse down-wind[4]. Although $PM_{2.5}$ is not specifically included as a parameter within the assessment, the risk levels associated with $PM_{10}$ and any subsequent mitigation measures would also apply to $PM_{2.5}$, as $PM_{2.5}$ is included within the $PM_{10}$ fraction.

## 1.2 Baseline Conditions

**Local Air Quality Management**

The proposed Bean Road Tunnel is located in the jurisdiction of Dartford Borough Council (DBC) and the local air quality management reports for DBC have been reviewed[5].

The predominant source of air pollution within DBC is road traffic, which has caused exceedances of the annual mean $NO_2$ air quality objective and 24-hour mean $PM_{10}$ objective. Due to these exceedances, DBC has declared four Air Quality Management Areas (AQMAs). The closest to the scheme are the Bean Road Interchange (Dartford AQMA No. 4) and London Road (Dartford AQMA No.2) AQMAs, both of which have been declared for exceedances of the annual mean $NO_2$ objective (but not the 24-hour mean $PM_{10}$ objective). The former is located approximately 600m south of the scheme and the latter is located approximately 975m north of the scheme.

The local authority is responsible for three automatic monitoring stations which monitor for $PM_{10}$. The results from 2011-2016 are presented in Table .

[3] The Scottish Office. 1998. Planning Advice Note PAN 50 Annex B, Controlling the Environmental Effects of Surface Mineral Workings, Annex B: The Control of Dust at Surface Mineral Workings. Edinburgh: The Scottish Office Development Department.
[4] Arup. 1995. The Environmental Effects of Dust from Surface Mineral Workings. PECD 7/1/468. Report on behalf of the Department of the Environment. London: HMSO.
[5] Dartford Borough Council 2017 Air Quality Annual Status Report (ASR) August 2017

**Table 1 Annual mean $PM_{10}$ Monitoring Results**

| Site ID | Site Type | In AQMA | $PM_{10}$ Annual Mean Concentration (µg/m$^3$) | | | | | Approximate distance from the proposed Bean Road Tunnel (m) |
|---|---|---|---|---|---|---|---|---|
| | | | 2012 | 2013 | 2014 | 2015 | 2016 | |
| Dartford Town Centre | Roadside | Yes | 24 | 28 | 24 | 23 | 33 | >4000 |
| Bean Interchange | Roadside | Yes | 21 | 21 | 27 | 26 | 27 | 650 |
| St Clements | Roadside | Yes | 22 | 24 | 25 | 20 | 24 | 1200 |

## Background

The assessment requires characterisation of the existing conditions regarding $PM_{10}$ concentrations to determine the sensitivity of the area. Due to the absence of urban background automatic monitoring sites within the area, and the current roadside monitoring sites not representative of the receptors, Defra background maps[6] (reference year 2015) were used to obtain background concentrations for pollutants in 1 km by 1 km grid square basis across the UK.

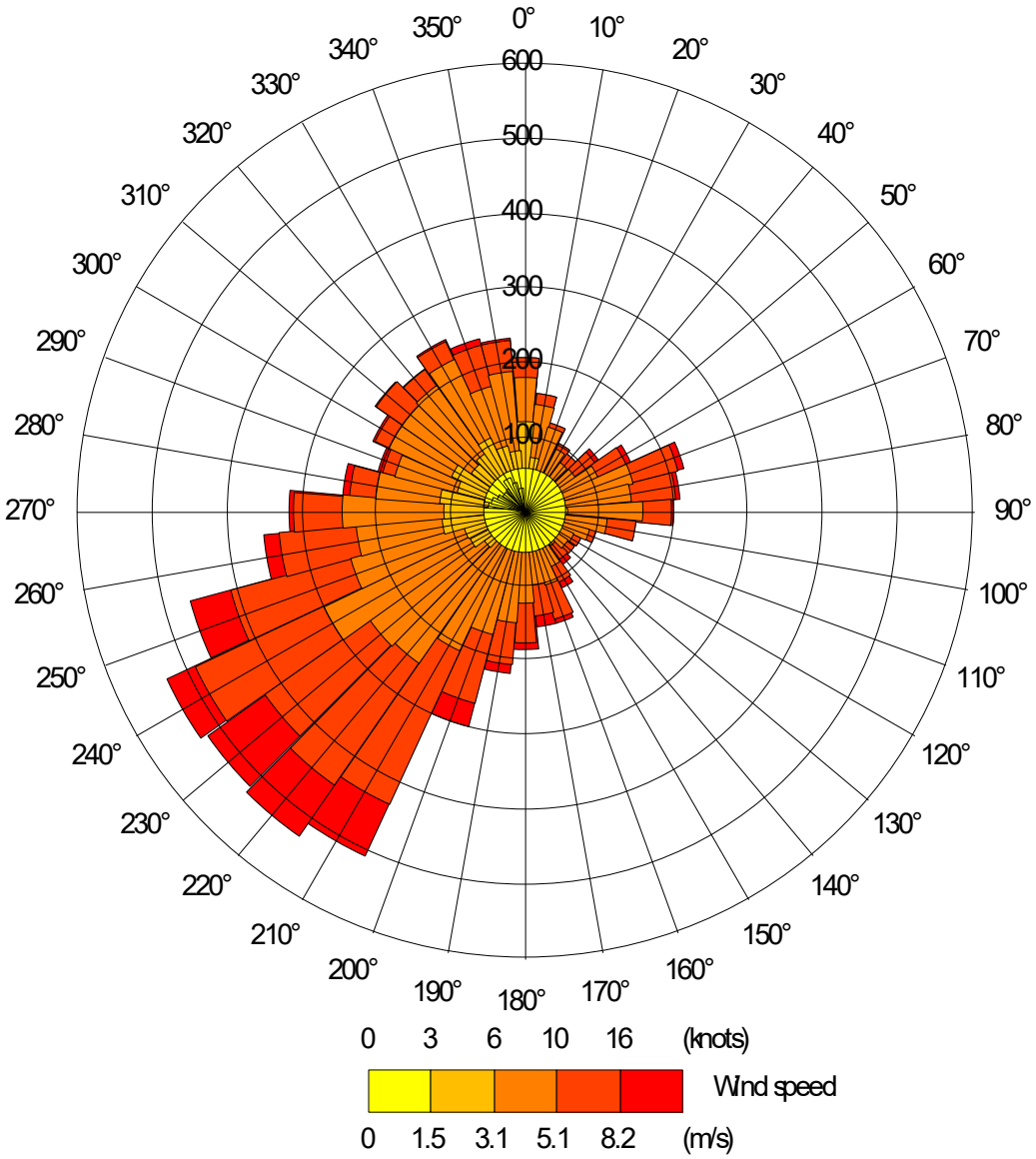
The mapped data were obtained from the website for the extent of the study area for 2016 (i.e. the same year as the latest available monitoring data). A $PM_{10}$ concentration of 16.6 µg/m$^3$ has been used in this assessment to represent the background concentration. The background maps by Defra are estimates based upon the principal local and regional sources of emissions and ambient monitoring data.

## Local Climate

A wind rose for the Southend weather station has been provided in Figure 1.1 for the data recorded in 2016. The wind rose plot shows the direction the wind blows from, in five wind-speed categories and the number of hours that it blows in each combination of speed and direction. The figure shows that the prevailing winds for Southend weather station are predominantly blowing from the south west.

[6] Department for Environment, Food and Rural Affairs, UK Air Information Resource website, https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2015. Accessed May 2019.

**Figure 1.1 Windrose for Southend Weather Station, 2016**



# 2. Dust Risk Assessment

## 2.1 Step 1 Identify the need for a detailed assessment

An assessment of potential demolition and construction impacts from emissions of dust and $PM_{10}$ was undertaken in accordance with IAQM methodology as described in Appendix A.

To present a worst-case approach, this assessment is based on the construction work boundary being the same as a new proposed lane on Bluewater Parkway to the west of the Bean Road Tunnel, on the Bluewater side. There are human receptors with 350 m of the boundary and, therefore, assessment is required. An approximate count of the relevant human receptors within the specified assessment bands was carried out as recommended in IAQM guidance[1], the results of which are set out in Table 2. The receptors have been identified as being of Medium or Low sensitivity based on the criteria set out in Appendix A. The indicative locations of key receptors and distances from the construction boundary are presented in the figure in Appendix B.

As per IAQM guidance[1], Low sensitivity receptors presented in Table 2 include parking spaces associated with the Bluewater Shopping Centre. Medium sensitivity receptors include workers at the Bluewater Shopping Centre. An approximation of the number of staff that work at the Bluewater shopping Centre has been included in the assessment.

Material from the tunnel area will be used as engineered fill within the existing lake area to the east, so the Haul-Route for the proposed Bean Road Tunnel will be contained within the Eastern Quarry and up to approximately 1 km in length. The exact route has not been finalised, although it is unlikely to be located within 350m of sensitive receptors. There are no anticipated movements of HDVs on the local road network, and less than 50 m of unpaved road within 350m of receptors on the Bluewater side of the tunnel. A number of Low sensitive receptors have been identified as presented in Table 2.

A review of Magic[7] and KCC's websites[8] showed that there are no ecological receptors within 50 m of the boundary. The nearest ecological site is Darenth Wood Site of Special Scientific Interest, approximately 450 m from the boundary. The potential effects of construction dust on ecological sites from on-site activities was not required to be considered further.

**Table 2 Dust soiling and human health receptor count**

| Receptor count | | | | |
|---|---|---|---|---|
| **Demolition, earthworks and construction** | | **Receptor sensitivity** | | |
| | | **High** | **Medium** | **Low** |
| Distance from boundary of the Bean Road Tunnel site | <20m | - | - | 1-10 |
| | <50m | - | - | 10-100 |
| | <100m | - | - | 10-100 |

[7] https://magic.defra.gov.uk/ - Accessed 21/05/2019
[8] https://www.kent.gov.uk/waste-planning-and-land/kent-landscape-information-system/resources/designated-sites-resources#null – Accessed 21/05/2019

| Receptor count | | | | |
|---|---|---|---|---|
| | <350m | - | 10-100 | >100 |
| **Trackout** | | **High** | **Medium** | **Low** |
| Distance from roads up to 50 m from the Bean Road Tunnel exit / entrance | <20m | - | - | 10-100 |
| | <50m | - | - | 10-100 |

## 2.2 Step 2 Assess the risk of dust impacts

The works associated with the construction of the Bean Road Tunnel is assumed to be completed in one stage. This assessment is therefore completed based on worst-case assumptions that potential dust impacts from activities; demolition, earthworks, construction, trackout could peak simultaneously.

The dust emission magnitudes of each activity have been specified with reference to the definitions of dust emission magnitudes in section A.3 and using professional judgement in line with IAQM guidance[1]. These are summarized in Table 3.

**Table 3 Dust activity and summary**

| Activity | Summary |
|---|---|
| Demolition | As no demolition activities are anticipated during activities associated with the construction of the Bean Road Tunnel, the potential effects of dust generated from demolition are not considered further. |
| Earthworks | Activities associated with the Bean Road Tunnel include the excavation of the tunnel commencing from the Eastern Quarry side (approximately 6,000 $m^3$ of material) with the formation of an embankment on the Bluewater side (approximately 1,000 $m^3$ of material). It is anticipated over 5000 $m^3$ of material would be stockpiled / disposed of in the Eastern Quarry and that there will be less than five earth moving vehicles operating at any one time. The site area is predicted to be less than 10,000 $m^2$. On this basis, the assessment of earthworks is based on a dust emission class of 'Small'. |
| Construction | The construction required for the Bean Road Tunnel includes; construction of the tunnel hubs on both the Bluewater side and the Eastern Quarry side, gabions located on the proposed tunnel plus north of an existing waterbody (approximately 3 m high), and a proposed Reed bed north of the tunnel. The overall total volume of material required is <25,000 $m^3$. On this basis, the assessment for construction is based on a dust emission class of 'Small'. |
| Trackout | During the construction phase, the maximum number of outward movements of HDVs is anticipated to be no more than five in any one day. The Haul-Route for the proposed Bean Road Tunnel is expected to be contained within the Eastern Quarry and up to approximately |

| Activity | Summary |
|---|---|
| | 1 km in length. The likely haul route has not been finalised, although it is unlikely to be within 350m of sensitive receptors. On this basis, the assessment for trackout is based on a dust emission class of 'Small'. |

Table 4 presents the dust emission magnitude for each activity based on the criteria set out in Appendix A.

**Table 4 Dust emission magnitude**

| Activity | Dust emission magnitude |
|---|---|
| Demolition | n/a |
| Earthworks | Small |
| Construction | Small |
| Trackout | Small |

## 2.3 Step 2B Define the sensitivity of the area

The Bean Road Tunnel site is primarily commercial / industrial in character with the Bluewater Shopping Centre to the west of the site and the Eastern Quarry to the east. The Eastern Quarry is currently separated from Bluewater Shopping Centre by a 70 m chalk spine approximately 20 m high which runs the length of B255 Bean Road. There are no residential premises near the site, however, the Bluewater Shopping Centre and and its car park are within 350 m of the proposed scheme. It is possible that impacts could be experienced by staff working at the Shopping Centre and / or members of the public using the car park if suitable mitigation measures are not employed.

Table 5 displays the sensitivities of the surrounding area to demolition, earthworks, construction and trackout based on the criteria set out in Appendix A, numbers of receptors within certain distance bands of the Bean Road Tunnel site, and existing $PM_{10}$ concentrations. The IAQM guidance recommends that the receptor distance is based on the distance from the source rather than the site boundary. This assessment was undertaken on the basis that all relevant activities (i.e. earthworks, construction and trackout) take place at the construction of a Proposed path at the western edge of the site. This represents a conservative assumption, as in practice most activities would not take place at the site boundary, thus increasing the distance between the source and the receptor.

**Table 5 Sensitivity of the area for the assessed sensitive human receptors**

| Potential Impact | Sensitivity of the surrounding area | | | |
|---|---|---|---|---|
| | Demolition | Earthworks | Construction | Trackout |
| Dust soiling | n/a | Low | Low | Low |
| Human health | | Low | Low | Low |

Table 5 shows that for human health and dust soiling impacts, the sensitivity of the area is categorized as Low for earthworks, construction and trackout activities, as a result of the number of car parking spaces (potential receptors) in close proximity to site and the worst case assumptions relating to where the works will occur.

## 2.4 Step 2C – Define the risk of impacts

Using the dust emission magnitudes in Table 4 and the sensitivity of the area provided in Table 5, the level of risk for each activity is provided in Table 6 for dust soiling and human health impacts.

**Table 6 Summary of the dust risks for human receptors**

| Potential Impact | Risk | | | |
|---|---|---|---|---|
| | Demolition | Earthworks | Construction | Trackout |
| Dust soiling | n/a | Negligible | Negligible | Negligible |
| Human health | | Negligible | Negligible | Negligible |

The results in Table 6 indicate that for potential both human health and dust soiling impacts, there is predicted to be a negligible risk from earthworks, construction and trackout activities.

## 2.5 Summary

The results in Table 6 indicate that there would be a Negligible risk to sensitive human receptors with regard to dust soiling and human health effects from earthworks, construction and trackout activities. Following guidance in the IAQM guidance, no mitigation measures beyond those required by legislation are required. However as a precautionary approach and good practice, proposed mitigation measures has been developed assuming this is a Low risk site.

Appropriate mitigation would also prevent or reduce potential dust or $PM_{10}$ (and $PM_{2.5}$) emissions which are associated with health effects such as exacerbating existing conditions including asthma and other lung conditions.

The proposed mitigation measures are set out in section 3.

# 3. Site-Specific Mitigation

## 3.1 Recommended mitigation measures

The results indicate that the Bean Road Tunnel site works are a Negligible risk for human health and dust soiling impacts. As mentioned in Section 2.5, the recommended mitigation for Low risk sites have been taken forward as a precautionary approach. Good practice mitigation measures should be implemented to reduce the potential for dust emissions to lead to dust effects at receptors in the vicinity of the Bean Road Tunnel site. The suggested good practice mitigation measures are detailed in Table 7 to Table 11 below.

The mitigation measures have been derived from those specified in the IAQM guidance and adapted to the activities associated with the Bean Road Tunnel site works. Measures such as those specified in the guidance would normally be sufficient to reduce construction dust nuisance and risks to human health to a not significant effect. These measures are listed in Table 7 to Table 11 with a recommendation as to whether or not they should be applied based on the risk levels identified in the dust assessment (i.e. Low risk). Some specific comments or observations have been added or amendments to the text undertaken, where appropriate and to ensure consistency with the CoCP. Some of the mitigation measures listed within IAQM guidance for trackout (mitigation numbers 44, 46, 47 and 48) were considered to represent general on-site activities and operation of haul roads, and were moved to the 'Operations' section (see Table 8) of the general mitigation measures required for all sites. The general mitigation measures were specified based on their highest risk category (i.e. based on an assumed Low risk to human receptors from dust soiling) as recommended by IAQM guidance.

When applying the mitigation measures, IAQM guidance states the following:

*"The most important aspects of the Dust Management Plan are assigning responsibility for dust management to an individual member of staff or the principal contractor, training staff to understand the importance of the issue, and communicating with the local community. Good dust management practices implemented at high risk sites have resulted in no or minimal complaints, which illustrates the value of the recommended approach."*

The mitigation measures set out in Table 7 to Table 11 do not specifically include assigning responsibility for dust management to a staff member or training staff on the importance of dust management and awareness of dust issues. However, these should be included within the proposed mitigation measures.

**Table 7 Mitigation for the Bean Road Tunnel site: Communications**

| Mitigation measure | Highly recommended / Desirable/ Not required |
|---|---|
| 1. Develop and implement a stakeholder communications plan that includes community engagement before work commences on site. | Not required |
| 2. Display the name and contact details of person(s) accountable for air quality and dust issues on the Bean Road Tunnel site boundary. This may be the Environment and Sustainability Manager. | Highly recommended |

| Mitigation measure | Highly recommended / Desirable/ Not required |
|---|---|
| 3. Display the head or regional office contact information. | Highly recommended |

**Table 8 Mitigation for the Bean Road Tunnel site: dust management**

| Mitigation measure | Highly recommended / Desirable/ Not required |
|---|---|
| 4. Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site. In London additional measures may be required to ensure compliance with the Mayor of London's guidance. The DMP may include monitoring of dust deposition, dust flux, realtime $PM_{10}$ continuous monitoring and/or visual inspections. | Desirable |
| **Site management** | |
| 5. Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner and record the measures taken. | Highly recommended |
| 6. Make the complaints log available to the local authority when asked. | Highly recommended |
| 7. Record any exceptional incidents that cause dust and/or air emissions, either on-site or off-site, and the action taken to resolve the situation in the log book. | Highly recommended |
| 8. Hold regular liaison meetings with other high-risk construction sites within 500 m of the Bean Road Tunnel site boundary to ensure plans are coordinated, and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/ deliveries which might be using the same strategic road network routes. | Not required |
| **Monitoring** | |
| 9. Undertake frequent on-site and off-site inspection where receptors (including roads) are nearby, to monitor dust and record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of the Bean Road Tunnel site boundary with cleaning to be provided if necessary. | Desirable |
| 10. Carry out regular site inspections to monitor compliance with the management plan, record inspection results and make an inspection log available to the local authority when asked. | Highly recommended |
| 11. Increase the frequency of site inspections by the person accountable for air quality and dust issues on-site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions. | Highly recommended |
| 12. Agree real-time $PM_{10}$ continuous monitoring locations with the local authority. | Not required |

| Mitigation measure | Highly recommended / Desirable/ Not required |
|---|---|
| **Preparing and maintaining the site** | |
| 13. Plan site layout so that machinery and dust-causing activities are located away from receptors, as far as is possible. | Highly recommended |
| 14. 2.4 m height hoarding to be installed along sections of the north and eastern boundary. | Highly recommended |
| 15. Fully enclose site or specific operations where there is a high potential for dust production and the Bean Road Tunnel is active for an extensive period. | Desirable |
| 16. Temporary drainage design to be installed which is designed to divert water to the attenuation pond to reduce the risk of site runoff of water or mud. | Highly recommended |
| 17. Keep the Bean Road Tunnel site fencing, barriers and scaffolding clean using wet methods. | Desirable |
| 18. Remove materials that have a potential to produce dust from the Bean Road Tunnel site as soon as possible, unless being re-used on-site. If they are being re-used on-site, cover as described below. | Desirable |
| 19. Topsoil stockpiles to be seeded with a low maintenance grass if present for more than six months to prevent wind whipping. | Desirable |
| **Operating vehicle/machinery and sustainable travel** | |
| 21. Ensure all vehicles switch off engines when stationary – no idling vehicles. | Highly recommended |
| 22. Avoid the use of diesel or petrol-powered generators and use mains electricity or battery powered equipment where practicable. | Highly recommended |
| 23. Impose and signpost a maximum speed limit of 15 mph. The speed limit on off-site haul routes can be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate). | Desirable |
| 24. Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials. | Not required |
| 25. Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking and car sharing). | Not required |
| **Operations** | |
| 26. Cutting, grinding or sawing activities should only take place in enclosed locations. Should this take place outside, equipment shall be fitted or operated in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems. | Highly recommended |
| 27. Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate. | Highly recommended |
| 28. Use enclosed chutes and conveyors and covered skips. | Highly recommended |
| 29. Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate. | Highly recommended |

| Mitigation measure | Highly recommended / Desirable/ Not required |
|---|---|
| 30. Ensure equipment is readily available on-site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods. All silos stored with bunds to capture any spillages with interceptors in place | Desirable |
| 44. Avoid any external dry sweeping of large areas. | Desirable |
| 46. Inspect on-site haul routes for integrity and instigate any necessary repairs to the surface as soon as reasonably practicable. | Not required |
| 47. Record all inspections of haul routes and any subsequent action in a site log book. | Desirable |
| 48. Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned. | Not required |
| **Waste management** | |
| 31. No burning of waste, materials or refuse on the Bean Road Tunnel site at any time. | Highly recommended |

**Table 9 Mitigation measure specific to demolition**

| Mitigation measure | Highly recommended / Desirable/ Not required |
|---|---|
| 32. Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust). | Not required |
| 33. Ensure effective water suppression is used during demolition operations. Hand-held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition, high-volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground. | Not required |
| 34. Avoid explosive blasting, using appropriate manual or mechanical alternatives. | Not required |
| 35. Bag and remove any biological debris or damp down such material before demolition. | Not required |

| Mitigation measure | Highly recommended / Desirable/ Not required |
|---|---|
| 36. Revegetate earthworks and exposed areas/ soil stockpiles to stabilise surfaces as soon as practicable. | Not required |
| 37. Use hessian fabric, mulches or tackifiers where it is not possible to revegetate or cover with topsoil, as soon as practicable. | Not required |

| Mitigation measure | Highly recommended / Desirable/ Not required |
|---|---|
| 38. Only remove the cover in small areas during work and not all at once. | Not required |

**Table 10 Mitigation measures specific to construction**

| Mitigation measure | Highly recommended / Desirable/ Not required |
|---|---|
| 39. Avoid scabbling (roughening of concrete surfaces) if possible. | Desirable |
| 40. Ensure sand and other aggregates are stored in enclosed buildings. | Desirable |
| 41. Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and under pressure and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery. | Not required |
| 42. For smaller supplies of fine powder materials, ensure bags are sealed after use and stored appropriately to prevent dust. | Not required |

**Table 11 Mitigation measures specific to trackout**

| Mitigation measure | Highly recommended / Desirable/ Not required |
|---|---|
| 43. Use water-assisted dust sweeper(s) on the access and local roads to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use. | Desirable |
| 45. Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport. | Desirable |
| 49. Implement a wheel-washing system with a grate to dislodge accumulated dust and mud) prior to leaving the site where reasonably practicable. | Desirable |
| 50. Ensure there is an adequate area of hard surfaced road between the wheel-wash facility and the site exit, wherever site size and layout permit. | Not required |
| 51. Access gates for construction vehicles to be located at least 10 m from receptors where possible. | Not required |

# 4. Conclusion

A construction dust assessment has been undertaken for the Bean Road Tunnel site, in line with IAQM guidance. The findings of the assessment show that the scheme will have a negligible risk of human health and dust soiling impacts. However, to ensure best practice, mitigation measures applicable to Low risk sites have been recommended for this scheme's construction phase. These measures should be set out in the CEMP.

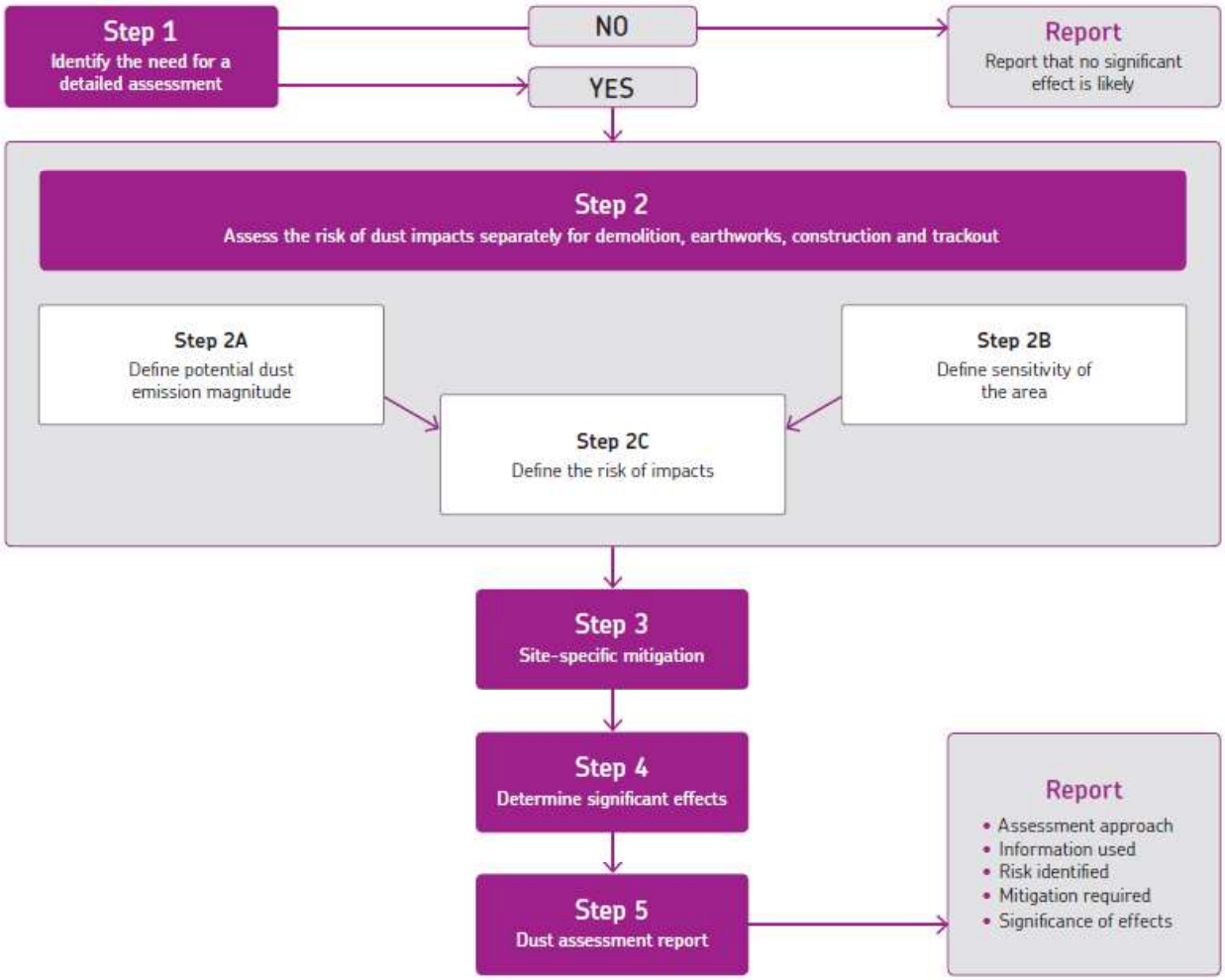
Therefore, the likely effect of dust emissions on human health, amenity and ecological sites during construction of the Bean Road Tunnel, with the mitigation measures applied, is concluded to be not significant.

# Appendix A. Methodology

## A.1 Overview of IAQM methodology

The methodology for the assessment of the construction impacts is based on a five-step approach as set out in below.

**Figure A.1 Structure of construction dust assessment**




## A.2 Step 1 Identify the need for a detailed assessment

An assessment would be required where there is:

- a human receptor within 350 m of the boundary of the Bean Road Tunnel site and/or within 50 m of the access route(s) used by construction vehicles on the public highway, up to 500 m from the site exit(s); and/or
- an ecological receptor within 50 m of the Bean Road Tunnel site and/or within 50 m of the access route(s) used by construction vehicles on the public highway, up to 500 m from the site exit(s).

The requirement for a dust risk assessment can be screened out where the above criteria are not met, and it can be concluded that the level of risk is Negligible, and any effects would be not significant. If there are human or ecological receptors within the distance criteria set out in Step 1, then Steps 2 to 4 should be undertaken, as shown in Figure 1.

## A.3 Step 2 Assess the risk of dust impacts

**Table A Dust Emission Criteria for Construction Activities**

| Construction Activity | Large | Medium | Small |
|---|---|---|---|
| **Demolition** | Total building volume >50,000 $m^3$, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities greater than 20 m above ground level. | Total building volume 20,000 $m^3$ - 50,000 $m^3$, potentially dusty construction material, demolition activities 10 m to 20 m above ground level | Total building volume <20,000 $m^3$, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities less than 10m above ground, demolition during wetter months. |
| **Earthworks** | Total site area >10,000 $m^2$, potentially dusty soil type (e.g. clay, which would be prone to suspension when dry due to small particle size), greater than 10 heavy earth-moving vehicles active at any one time, formation of bunds greater than 8 m in height, total material moved greater than 100,000 tonnes; | Total site area 2,500 $m^2$ - 10,000 $m^2$, moderately dusty soil type (e.g. silt), five to 10 heavy earth-moving vehicles active at any one time, formation of bunds 4 m to 8 m in height, total material moved 20,000 tonnes to 100,000 tonnes; | Total site area <2,500 $m^2$, soil type with large grain size (e.g. sand), less than five heavy earth-moving vehicles active at any one time, formation of bunds less than 4 m in height, total material moved less than 20,000 tonnes, earthworks during wetter months. |
| **Construction** | Total building volume > 100,000 $m^3$, piling, on-site concrete batching; sandblasting. | Total building volume 25,000 $m^3$ - 100,000 $m^3$, potentially dusty construction material (e.g. concrete), piling, on-site concrete batching. | Total building volume < 25,000 $m^3$, construction material with low potential for dust release (e.g. metal cladding or timber). |
| **Trackout**[1] | > 50 heavy duty vehicle (HDV) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length greater than 100 m. | 10 - 50 HDV outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m to 100 m | < 10 HDV outward movements in any one day, surface material with low potential for dust release, unpaved road length less than 50 m. |

### Step 2A Define the potential dust emission magnitude.

The potential dust emission magnitude is based on the scale of the anticipated works and is classified as small, medium or large. Table A presents the dust emission criteria outlined for each construction activity.

Note 1: Trackout refers to the transport of dust and dirt from the site onto the public road network, where it may be deposited and re-suspended by other vehicles using the road network. Only receptors within 50 m of the route(s) used by vehicles on the public highway up to 500 m from the Bean Road Tunnel site exit(s) are considered to be at risk.

### Step 2B Define the sensitivity of the area

The sensitivity of the area takes account of a number of factors:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors;
- the local background $PM_{10}$ concentrations; and
- site-specific factors.

Table B presents indicative examples of classification groups for the varying sensitivities of people to dust soiling effects, to the health effects of $PM_{10}$ and the sensitivities of receptors to ecological effects. A judgement is made at the site-specific level where sensitivities may be higher or lower, for example a soft fruit business may be more sensitive to soiling than an alternative industry, such as coal mining, in the same location. Box 6, Box 7 and Box 8 within IAQM guidance outlines more detailed guidance for defining sensitivity.

**Table B Indicative Examples of Sensitivity of Different Types of Receptors**

| Sensitivity of Receptor | Sensitivities of people and ecological receptors | | |
|---|---|---|---|
| | Dust Soiling Effects | Health Effects of $PM_{10}$ | Ecological effects |
| **High**[1] | Users can reasonably expect the enjoyment of a high level of amenity. The appearance, aesthetics or value of their property would be diminished by soiling, and the people or property would reasonably be expected to be present continuously.<br><br>At least regularly for extended periods, as part of | Locations where members of the public are exposed over a period relevant to the Air Quality Objective for $PM_{10}$ (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).<br><br>Indicative examples include residential properties. Hospitals, schools and | Locations with an international or national designation where the designated features may be affected by dust soiling.<br><br>Locations where there is a community of a particularly dust-sensitive species such as vascular species included in the Red Data List for Great Britain[9]. |

[9] Cheffings, C.M. and Farrell, L. (Eds.), Dines, T.D., Jones, R.A., Leach, S.J., McKean, D.R., Pearman, D.A., Preston, C.D., Rumsey, F.J., Taylor, I. 2005. *The Vascular Plant Red Data List for Great Britain.* Species Status 7: 1-116. Peterborough: Joint Nature Conservation Committee.

| Sensitivity of Receptor | Sensitivities of people and ecological receptors | | |
|---|---|---|---|
| | Dust Soiling Effects | Health Effects of $PM_{10}$ | Ecological effects |
| | the normal pattern of use of the land.<br><br>Indicative examples include dwellings, museums and other culturally important collections, medium and long-term car parks and car showrooms. | residential care homes (if present) should also be considered as having equal sensitivity to residential areas for the purpose of this assessment. | Indicative examples include a Special Area of Conservation designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings. |
| **Medium**[1] | Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home.<br><br>The appearance, aesthetics or value of their property would be diminished by soiling.<br><br>The people or property would not reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.<br><br>Indicative examples include parks and places of work. | Locations where the people exposed are workers, and exposure is over a period relevant to the Air Quality Objective for $PM_{10}$ (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).<br>Indicative examples may include office and shop workers but will generally not include workers occupationally exposed to $PM_{10}$, as protection is covered by Health and Safety at Work legislation. | Locations where there are particularly important plant species, where their dust sensitivity is uncertain or unknown.<br><br>Locations with a national designation where the features may be affected by dust deposition.<br>An indicative example is a Site of Special Scientific Interest with dust sensitive features. |
| **Low**[1] | The enjoyment of amenity would not reasonably be expected.<br><br>Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling. | Locations where human exposure is transient.<br><br>Indicative examples include public footpaths, playing fields, parks and shopping streets. | Locations with a local designation where the features may be affected by dust deposition.<br><br>An indicative example is a Local Wildlife Site with dust sensitive features. |

| Sensitivity of Receptor | Sensitivities of people and ecological receptors | | |
|---|---|---|---|
| | Dust Soiling Effects | Health Effects of $PM_{10}$ | Ecological effects |
| | There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods as part of the normal pattern of use of the land.<br><br>Indicative examples include playing fields, farmland (unless it is commercially-sensitive horticultural farmland), footpaths, short-term car parks and roads. | | |

Table C and Table D set out the selection criteria for the sensitivity of the area to dust soiling effects on people and property, and the selection criteria for the sensitivity of the area to human health impacts, respectively. Table E sets out the selection criteria for the sensitivity of the area with regard to impacts on ecological receptors.

**Table C Criteria for the sensitivity of the area to dust soiling effects on people and property**

| Receptor sensitivity | Number of receptors | Distance from the source (m) | | | |
|---|---|---|---|---|---|
| | | <20 | <50 | <100 | <350 |
| High | >100 | High | High | Medium | Low |
| | 10 – 100 | High | Medium | Low | Low |
| | 1 – 10 | Medium | Low | Low | Low |
| Medium | >1 | Medium | Low | Low | Low |
| Low | >1 | Low | Low | Low | Low |

**Table D Criteria for the sensitivity of the area to human health**

| Receptor sensitivity | Annual mean $PM_{10}$ concentration | Number of receptors | Distance from the source (m) | | | | |
|---|---|---|---|---|---|---|---|
| | | | <20 | <50 | <100 | <200 | <350 |
| High | > 32 µg/m$^3$ | >100 | High | High | High | Medium | Low |
| | | 10 – 100 | High | High | Medium | Low | Low |
| | | 1 – 10 | High | Medium | Low | Low | Low |
| | > 28 µg/m$^3$ | >100 | High | High | Medium | Low | Low |
| | | 10 – 100 | High | Medium | Low | Low | Low |
| | | 1 – 10 | High | Medium | Low | Low | Low |
| | > 24 - 28 µg/m$^3$ | >100 | High | Medium | Low | Low | Low |
| | | 10 – 100 | High | Medium | Low | Low | Low |
| | | 1 – 10 | Medium | Low | Low | Low | Low |
| | < 24 µg/m$^3$ | >100 | Medium | Low | Low | Low | Low |
| | | 10 – 100 | Low | Low | Low | Low | Low |
| | | 1 – 10 | Low | Low | Low | Low | Low |
| Medium | > 32µg/m$^3$ | >10 | High | Medium | Low | Low | Low |
| | | 1 – 10 | Medium | Low | Low | Low | Low |
| | 28 - 32µg/m$^3$ | >10 | Medium | Low | Low | Low | Low |
| | | 1 – 10 | Low | Low | Low | Low | Low |
| | 24 - 28µg/m$^3$ | >10 | Low | Low | Low | Low | Low |
| | | 1 – 10 | Low | Low | Low | Low | Low |
| | < 24µg/m$^3$ | >10 | Low | Low | Low | Low | Low |
| | | 1 – 10 | Low | Low | Low | Low | Low |
| Low | N/A | >1 | Low | Low | Low | Low | Low |

**Table E Criteria for the sensitivity of the area to ecological impacts**

| Receptor sensitivity | Distance from the source (m) | |
|---|---|---|
| | <20 | <50 |
| High | High | Medium |
| Medium | Medium | Low |
| Low | Low | Low |

## A.4 Step 2C Define the risk of impacts

The dust emission magnitude is then combined with the sensitivity of the area to determine the overall risk of impacts with no mitigation measures applied. The matrices in Table F provide a method of assigning the level of risk for each activity. These can then be used to determine the level of mitigation that is required.

**Table F Determination of risk of dust impacts**

| Sensitivity | Dust emission magnitude | | |
|---|---|---|---|
| | Large | Medium | Small |
| **Demolition** | | | |
| High | High risk | Medium risk | Medium risk |
| Medium | High risk | Medium risk | Low risk |
| Low | Medium risk | Low risk | Negligible |
| **Earthworks** | | | |
| High | High risk | Medium risk | Low risk |
| Medium | Medium risk | Medium risk | Low risk |
| Low | Low risk | Low risk | Negligible |
| **Construction** | | | |
| High | High risk | Medium risk | Low risk |
| Medium | Medium risk | Medium risk | Low risk |
| Low | Low risk | Low risk | Negligible |

| Sensitivity | Dust emission magnitude | | |
|---|---|---|---|
| | Large | Medium | Small |
| **Trackout** | | | |
| High | High risk | Medium risk | Low risk |
| Medium | Medium risk | Low risk | Negligible |
| Low | Low risk | Low risk | Negligible |

## A.5 Step 3 Site-specific mitigation

During the construction phase, it would be important to control dust levels for High, Medium and Low risk construction activities. In order to avoid significant impacts from dust during the construction phase, suitable mitigation measures should be adopted. Following the identification of a risk category for the demolition, earthworks, construction and trackout activities based on Table F, appropriate mitigation measures can be identified. Activities identified as High risk would require a greater level of mitigation than those identified as Low risk.

A selection of these measures has been specified for Low risk to High risk sites in IAQM guidance[1] as measures suitable to mitigate dust emissions from activities such as those which would be undertaken during the construction of the Bean Road Tunnel.

## A.6 Step 4 Determine significant effects

Following Step 2 (identification of the risk of dust effects occurring for each activity), and Step 3 (identification of appropriate site-specific mitigation), the significance of the potential dust effects can be determined. The recommended mitigation measures are considered to be sufficient based on the successful application of these measures at other large construction sites to reduce emissions of dust, such that a significant effect would not occur at off-site receptors.

The approach in Step 4 of IAQM dust assessment guidance[1] has been adopted to determine the significance of effects with regard to dust emissions. The guidance states the following:

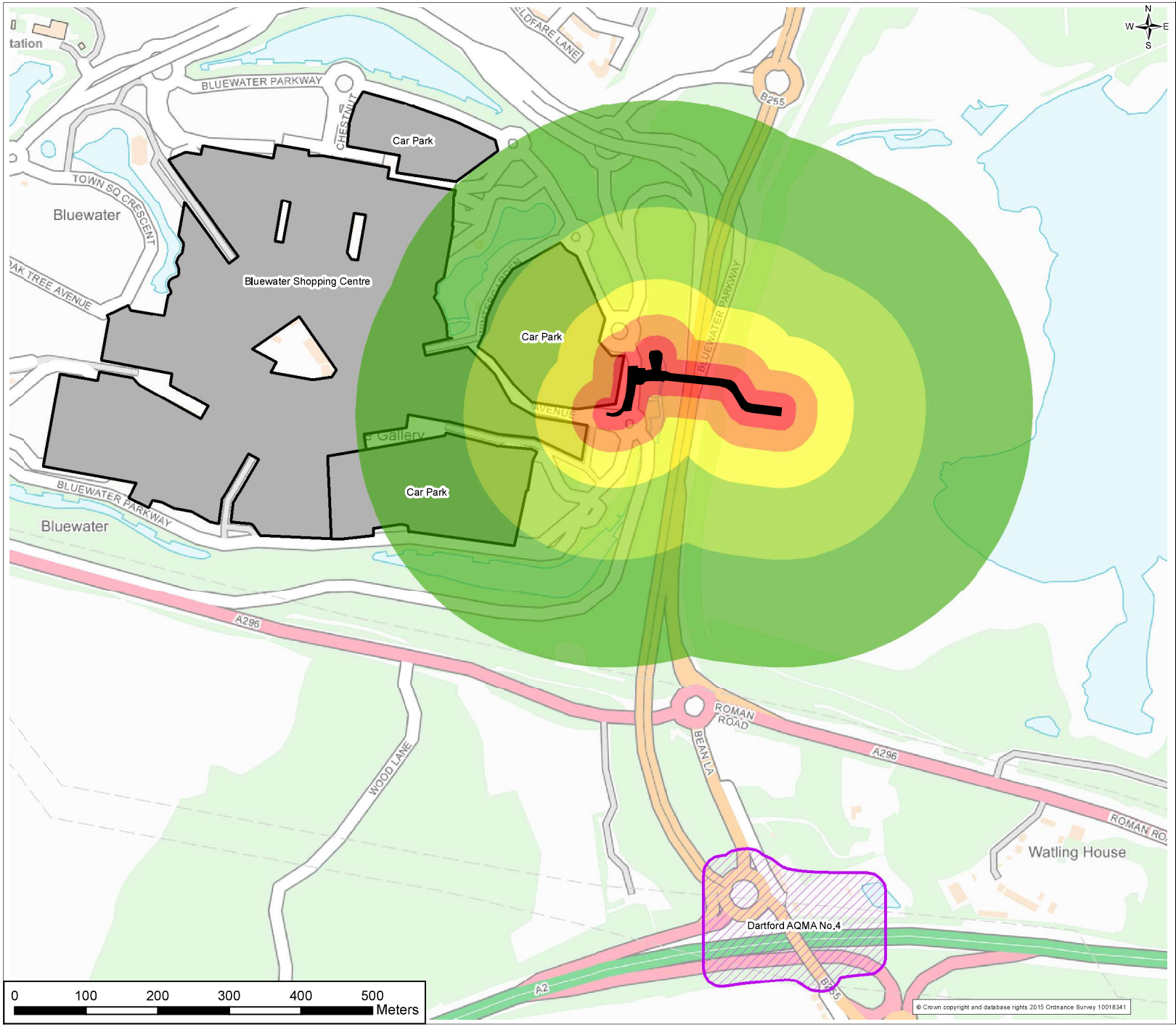
*"For almost all construction activity, the aim should be to prevent significant effects on receptors through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be not significant."*

IAQM guidance also states that:

*"Even with a rigorous DMP [Dust Management Plan] in place, it is not possible to guarantee that the dust mitigation measures will be effective all the time, and if, for example, dust emissions occur under adverse weather conditions, or there is an interruption to the water supply used for dust suppression, the local community may experience occasional, short-term dust annoyance. The likely scale of this would not normally be considered sufficient to change the conclusion that with mitigation the effects will be not significant."*

Step 4 of IAQM guidance[1] recognises that the key to the above approach is that it assumes that the regulators, such as the respective local authority, ensure that the proposed mitigation measures are implemented. The management plan should include the necessary systems and procedures to facilitate regular checking by the regulators to ensure that mitigation is being delivered, and that it is effective in reducing any residual effect to not significant in line with the guidance.

# Appendix B. Figure

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# FIGURE B.1

Legend

- AQMAs
- Bluewater Shopping Centre
- Construction Area

**Construction Area Buffers**

**Distance Bands (Meters)**

- 20
- 50
- 100
- 200
- 350

| Rev. | Date | Purpose of revision | Drawn | Check'd | Rev'd | Appr'd |
|---|---|---|---|---|---|---|
| 0 | 11/06/2019 | Initial Issue | CH | DW | SB | SB |

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